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METHODS OF TEST FOR PULP

PART X DETERMINATION OF KAPPA NUMBER

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METHODS OF TEST FOR PULP

PART X DETERMINATION OF KAPPA NUMBER

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METHODS OF TEST FOR PULP

PART X DETERMINATION OF KAPPA NUMBER

0. FOREWORD

0.1 This Indian Standard (Part X) was adopted by the Indian Standards Institution on 30 August 1975, after the draft finalized by the Paper and Its Products (Excluding Packaging Materials) Sectional Committee had been approved by the Chemical Division Council.

0.2 For certain types or pulps it is necessary to know the degree o f delignification or pulp. This degree of delignification is measured in terms or kappa number of pulp. This method is adapted to the determination or the relative hardness, bleachability or degree of delignification or pulp. It may be used for all types and grades of chemical and semichemical, unbleached and semibleached pulps obtained in yields under 75 percent.

0.3 This standard is essentially based on ISO/R 302-1963 'Determination of kappa number of pulp' issued by ??? International Organization for Standardization.

0.4 In reporting the Tesults of a test ??? analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS:2-1960*.

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1. SCOPE

1.1 This standard (Part X) prescribes the method for determination ??? kappa number or ??? pulp.

2. TERMINOLOGY

2.0 For the purpose or this standard, the following definition shall apply.

2.1 Kappa Number — It is the number of millilitres of 0.1 N potassium permanganate solution consumed under the conditions of this test by one gram or oven-dry pulp. The results are corrected to 50 percent consumption of the permanganate added.

*Rules for rounding off numerical values (*revised*).

3. QUALITY OF REAGENTS

3.1 Unless otherwise specified, pure chemicals and distilled water (*see* IS: 1070-1960*), freshly boiled and cooled, shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

4. APPARATUS

4.1 Agitator — propeller type, made of glass or other non-corrosive material (a plastics or glass-covered magnetic stirrer may also be used).

4.2 Disintegration Apparatus — high speed, wet type. As an example, a kitchen mixer or similar apparatus which disintegrates the pulp completely with 8 minimum of damage to the fibres may be used.

4.3 Bath —capable of maintaining a constant temperature of 27.0±0.2°C in ??? reaction vessel.

5. REAGENTS

5.1 Potassium Permanganate Solution — 0.1 000 ±0.000 5N.

5.2 Sodium Thiosulphate Solution — 0.2 N. Normality shall be known to an accuracy ??? ±0.0005 N.

5.3 Potassium Iodide Solution — 15 percent (*m/v*).

5.4 Sulphuric Acid — 4.0 N.

5.5 Starch Indicator Solution — 0.2 percent.

6. PREPARATION OF SAMPLE

6.1 Air-Dried Pulp Sheet — Tear 3 to 10 g of ??? pulp into small pieces.

6.2 Screened Slush Pulps — Make a 3 to 10 g air-dry ??? by filtering on a Buchner funnel, avoiding any loss of fibres. Air-dry the pad and tear it into small pieces.

6.3 Unscreened Pulps — If the pulp sample is taken from unscreened pulp which is normally screened ??? bleaching or other processing, ??? the shives and ??? shall be removed from the sample by screening. The method or screening shall be stated along with the test results and should ??? chosen to give results similar to those obtained by the industrial screening of the pulp. Complete the preparation of the screened pulps as in **6.2**.

*Specification for water, distilled quality (*revised*).

7 PROCEDURE

7.1 Carry out two determinations.

7.2 Prior to weighing the test samples, condition the sample for not less than 20 minutes in the atmosphere near the balance.

7.3 Weigh to the nearest 0.001 g that amount or pulp which shall consume approximately 50 percent of the potassium permanganate solution (*see* Note 1). The permanganate consumption shall ??? between 30 ??? 70 percent. At the same time, weigh a separate test sample and determine the moisture content.

NOTE 1 — *Use of Smaller Quantities* — A suggested control method for full chemical pulps uses 50 ml or potassium permanganate solution, 50 ml ??? sulphuric acid. 400 ml of water and *???* appropriate amount ??? pulp. In this case, when only half the volumes and quantities of pulp are used, the permanganate consumption *a* in 8.3 should ??? changed to 2 *a*. If *a* = 25 ml (50 percent), the factor *d* thus is 1.000. The method follows the standardized procedure in all other respects.

This variant should give results simitar ??? those obtained by the standardized method, but it cannot be considered as complying with the standardized procedure, and its use should be stated with the test results.

7.4 Disintegrate the test sample in 500 ml of distilled water until free from fibre clots and from large fibre bundles. Avoid methods of disintegration which involve extensive cutting of the fibres. Transfer the disintegrated test samples to a 1500-ml reaction beaker, using about 300 ml or distilled water to rinse out the apparatus *(see* Note 2). Place the beaker in a constant-temperature bath adjusted so that the reaction temperature stays at 27.0±0.2°C during the entire reaction (*see* Note 3). Adjust the stirrer to obtain a vortex approximately 25 mm ??? in the solution.

NOTE 2 — *Disintegration in the Reaction Beaker* — Easily disintegrated pulp could ??? slurried directly in the reaction beaker. For the variant using smaller ??? a one-litre beaker of the type ??? in kitchen mixers is recommended as a combined disintegrator and reaction beaker.

NOTE 3 — *Correction for Reaction Temperature* — Where 8 constant temperature bath is not available, determine the temperature after the reaction has been taking place for 5 minutes and assume that ??? average reaction temperature throughout the test. If this temperature is not higher than 32°C or lower than 22°C, correct the kappa number as follows:

$$K = \frac{a\,d}{m}\,[\,1 + 0{\cdot}013\,(\,27 - t\,)\,]$$

where

t = actual reaction temperature in °C.

This variant shall usually give results similar ??? those obtained by the standardized method, ??? since it ??? not conform ??? the standardized procedure, its use should be stated with the test results.

7.5 Pipette 100.0 ± 0.1 ml or the potassium permanganate solution and 100 ml of the sulphuric acid into a 250-ml beaker. Bring this mixture to 27°C and add it quickly to the disintegrated test sample and simultaneously start a stop-watch. Rinse out ??? 250-ml beaker, using not more than 5 ml of water, ??? add the washings to the reaction mixture. Make the total volume to 1 000 ml. At the ??? of exactly 10.0 minutes, terminate the reaction by adding 20 ml of the potassium iodide solution from a graduated test tube. Immediately after mixing, but without filtering out the fibres, titrate the free iodine with the sodium thiosulphate solution. Add a few drops of starch indicator solution towards the ??? of the reaction.

7.6 Carry out a blank determination using exactly the same method a s above, but omitting the pulp.

8. RESULT

8.1 Method of Calculation — Calculate the kappa number as follows:

$$a = \frac{(b-c)\,N}{0{\cdot}1}, \text{ and } K = \frac{a\,d}{m}$$

where

a = volume in ml Of 0.1 N potassium permanganate solution,

b = volume in ml or sodium thiosulphate solution consumed in blank determination,

c = volume in ml or sodium thiosulphate solution consumed in the test,

N= normality of sodium thiosulphate solution,

K = kappa number,

d = factor for correction to 50 percent permanganate consumption dependent on the value of a, and

m = mass in g of the test specimen or oven-dry pulp.

8.1.1 An example showing the method of calculation is given in Appendix A.

8.2 Accuracy of Determination — Report the kappa number to the following precision:

Under 100	to nearest 0.1
Over 1 000	in whole numbers

8.3 Correction Factor *d* — The correction factor *d* for various values of *a* is given below:

a	0	1	Z	3	4	5	6	7	8	9
	Correction factors, *d*									
JO	0.958	0.960	0.962	0.964	0.966	0.968	0.970	???	???	0.977
40	0.979	0.981	0.983	0.985	0.981	0.989	0.991	0.994	0.996	0.998
50	1.000	1.002	1.004	1.006	1.009	1.011	1.013	1.015	1.017	1.019
60	1.022	1.024	1.026	1.028	1.030	1.033	1.035	1 . 0 3 1	1.039	1.042
70	1.044									

NOTE — The correction factors given above are based on the following equation:

$$\log k = \log \frac{a}{m} + 0{\cdot}00090\ (a-50)$$

APPENDIX A

(Clause 8.1.1)

EXAMPLE OF CALCULATION

Mass or test sample of air-dry pulp, in g 2-200

Oven-dry content of test sample, percent 915

Mass of test sample of oven-dry pulp (*■ ing 2013

Volume or sodium thiosulphate solution consumed in blank determination (6), in ml 52-4

Volume or sodium thiosulphate solution consumed in test (c),inml 210

Normality of sodium thiosulphate solution *(S)* 01910

Volume of 0*1 N potassium permanganate solution consumed (*a*) in uq $= \dfrac{(52{\cdot}4-21{\cdot}0)\times 0{\cdot}1910}{0{\cdot}10}$

60·0 ml 0·1 N $KMnO_4$

Correction factor (d) $= 1{\cdot}022$

Kappa number (*K*) $= \dfrac{60{\cdot}0\times 1{\cdot}022}{2{\cdot}013} = 30{\cdot}5$

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Bass Unit

Quintity	*Unit*	*Symbol*
Length	metre	m
Mass	killogram	kg
Time	second	s
Electric current	ampers	A
Thermodynamic temperature	kelvin	K
Luminous Intensity	candela	cd
Amount at substence	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradien	sr

Derived Unite

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newten	N	1 N = 1 Kg. 1 m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flus	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m???
Frequency	hertz	Hz	1 HZ = 1 $c/s(s^{-1})$
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pe = 1 N/m^2

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